The opinion in support of the decision being entered today
is *not* binding precedent of the Board

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte TERESA GROCELA ROCHA,
JONATHAN LLOYD MALE, JENNIFER KATHLEEN REDLINE.
ALISON LIANA PALMATIER, KAIDONG CHEN,
DAN HANCU, GRIGORII LEV SOLOVEICHIK,
ERIC BUDESHEIM, and AARON JOSEPH SIMON

Appeal 2007-4188
Application 10/743,646
Technology Center 1700

Decided: September 25, 2007

Before EDWARD C. KIMLIN, CHARLES F. WARREN, and
PETER F. KRATZ, *Administrative Patent Judges*.

WARREN, *Administrative Patent Judge*.

DECISION ON APPEAL

Applicants appeal to the Board from the decision of the Primary Examiner finally rejecting for at least the second time claims 1 through 15, 24, and 25 in the Office Action mailed October 21, 2005. 35 U.S.C. §§ 6 and 134(a)(2002); 37 C.F.R. § 41.31(a)(2005).

We reverse the decision of the Primary Examiner.

Claim 1 illustrates Appellants' invention of a catalyst system for the reduction of NOx in effluent gases from combustion sources, and is representative of the claims on appeal:

1. A catalyst system for the reduction of NOx in effluent gases from combustion sources comprising

a catalyst comprising

a metal oxide catalyst support,

a catalytic metal oxide comprising at least one of gallium oxide and indium oxide, and

a promoting metal comprising at least one of silver, cobalt, vanadium, molybdenum, tungsten, zinc, tin and bismuth,

wherein the catalyst comprises about 5 to about 31 mol% catalytic metal oxide and about 0.5 to about 9 mol% promoting metal; and

a reductant comprising a fluid hydrocarbon having at least 4 carbon atoms.

The Examiner relies upon the evidence in these references:

Okimura	US 5,955,046	Sep. 21, 1999
Kepner	US 6,342,191 B1	Jan. 29, 2002
Balmer-Millar	US 2003/0118960 A1	Jun. 26, 2003
Park	US 6,706,660 B2	Mar. 16, 2004

Appellants request review of the grounds of rejection under 35 U.S.C. § 103(a) (Br. 4-5): claims 1 through 12 and 15 under as unpatentable over Okimura in view of Park and Kepner (Answer 3); claims 13, 14, 24, and 25 as unpatentable over Okimura in view of Park and Kepner, as applied above, further in view Balmer-Millar (*id.* 5).

The issues in this appeal are whether the Examiner has carried the burden of establishing a prima facie case of obviousness in the grounds of rejection advanced on appeal.

The plain language of independent claim 1 specifies a catalyst system comprising at least two components. First, at least any amount of any catalyst comprising at least (1) any amount of any metal oxide catalyst support; (2) at least one catalytic metal oxide comprising at least any amount of at least one of gallium oxide and indium oxide; and (3) at least one promoting metal comprising at least any amount of at least one silver, cobalt, vanadium, molybdenum, tungsten, zinc, tin and bismuth, wherein the catalyst comprises about 5 to about 31 mol% catalytic metal oxide and about 0.5 to about 9 mol% promoting metal. And, second, at least any amount of any reductant comprising at least any amount of any fluid hydrocarbon having at least 4 carbon atoms. Independent claim 15 differs from claim 1 in that the "a catalytic metal oxide" and "a promoting metal" are each defined as a group consisting essentially of the same ingredients listed in claim 1 and combinations thereof. Appellants describe the term "promoting metal" as encompassing "elemental metals, metal oxides or salts of the promoting meal" (Specification 3:¶0013). The open-ended term "comprising" used in transition and in the body of the claims, open claims 1 and 15 to systems including catalysts having ingredients in addition to those specified. *See, e.g., Exxon Chem. Pats., Inc. v. Lubrizol Corp.*, 64 F.3d 1553, 1555, 35 USPQ2d 1801, 1802 (Fed. Cir. 1995) ("The claimed composition is defined as comprising - meaning containing at least - five specific ingredients."); *In re Baxter*, 656 F.2d 679, 686-87, 210 USPQ 795, 802-03 (CCPA 1981) ("As long as one of the monomers in the reaction is propylene, any other monomer may be present, because the term 'comprises' permits the *inclusion* of other steps, elements, or materials.").

We find Okimura would have disclosed to one of ordinary skill in this art a catalytic material for treating NOx which has a complex oxide as the main phase, wherein the complex oxide has a specific crystal structure that is a spinel structure, and contains aluminum, zinc, and gallium as main metallic elements. The complex oxide having a spinel structure is a solid solution in which the mole fraction % of each elements on an oxide basis is aluminum, in the amount of greater than 0 to less than about 80 mol%; of gallium, in the amount of greater than 0 to less than about 80 mol%; and of zinc, in the amount of greater than 0 to less than 50 mol%. "[T]he ternary phase diagram of the pseudo ZnO-Al_2O_3-Ga_2O_3 system (that is a solid solution capable of continuously varying its composition)" is illustrated in Fig. 1. *See* Okimura, e.g., Abstract, col. 1, l. 62, to col. 2, l. 9, col. 2, l. 60, to col. 3, l. 21, col. 3, l. 55, to col. 4, l. 8, and Fig. 1. Okimura discloses the catalytic material can be prepared from, among other things, a mixture of the metal oxides, and can contain other materials including, among other things, small amounts of unreacted compounds of component elements and compounds other than the complex oxide to the extent the complex oxide is contained as a main component (*id.* col. 3, ll. 22-38 and 42-53). Okimura discloses a system for treating NOx in exhaust gases from internal combustion engines, e.g., lean-burn engines, diesel engines, and automobile engines, with the catalytic material through reduction, wherein the reductant can be "hydrocarbons," including methane and propylene, as well as hydrocarbons in the exhaust stream of an automobile (*id.*, e.g., col. 1, ll. 49-55, col. 2, ll. 10-40, col. 4, ll. 10-17 and 29-54, and col. 8, l. 65 to col. 9, l. 10). The catalyst material can be present in an apparatus for treating NOx,

in the form of, among other things, powders, wherein the apparatus can be a gas purifier position in the engine exhaust passage and is filled with the powders (*id.* col. 4, ll. 10-27, and col. 8, 1. 65, to col. 9, l. 10).

We find Park would have disclosed to one of ordinary skill in this art a catalytic material for treating NOx which is a metal or metal oxide doped oxide catalyst in which a metal oxide support material, including alumina, on a ceramic substrate, is doped with a metal promoter or oxide selected from the group consisting of, among others, indium, gallium, tin, silver, cobalt, vanadium, oxides thereof, and combinations thereof (Park, e.g., Abstract, col. 2, ll. 5-26, col. 3, ll. 16-36 and 41-55, col. 16, ll. 57-62). A preferred group of metal promoters is indium, gallium, silver, and tin, oxides thereof and combinations thereof (*id.* col. 3, ll. 56-59). Park discloses "alumina has been known to activate the NOx reduction step" (*id.* col. 3, l. 61, to col. 4, l. 1-12). Park discloses the disclosed metal or metal oxide doped alumina catalysts are "best suited or use in a lean NOx exhaust aftertreatment system" wherein the engines can be lean-burn diesel and gasoline engine sand the exhaust gas includes, among other things, hydrocarbons that can be used as the reductant (*id.* col. 17, ll. 7-42). The metal or metal oxide doped alumina catalysts can be deposited within the catalytic converted for an exhaust stream (*id.* col. 17, ll. 43-50).

We find Balmer-Millar discloses the same and similar metal or metal oxide doped metal oxide catalysts as Park, but further including gallium oxide along with alumina as a metal oxide support material, similarly preferring indium, gallium, silver, and tin, oxides thereof and combinations thereof, for treating NOx in "lean-burn" engines (Balmer-Millar, e.g.,

Abstract, ¶¶ 0002, 0009, 0013-0015, 0021-0026, and 0046). Balmer-Millar discloses the metal or metal oxide doped metal oxide catalysts can be used in the exhaust streams of lean-burn engines including, among other things, diesel and gasoline engines, wherein the exhaust contains the material which acts as the reductant (*id.*, e.g., 0003, 0009, 0015-0020, 0046, and 0047).

A discussion of Kepner is not necessary to our decision.

Appellants contend claims 1 and 15 specify a catalyst in which gallium oxide is present, which is not the case with Okimura's spinel structure (Br. 7). Appellants contend it is well known in the literature that "spinel structures comprise [a] plurality of metals with a very specific ratio of metal to oxygen," that is "a cubic close packed structure with a generic formula of XY_2O_4," and points to Okimura's Fig. 1 as explained therein. Appellants thus contend Okimura's catalyst "does not include Ga oxide" even though gallium oxide is used "as an ingredient for the final product of complex oxides which form the main phase of the catalyst" (*id.* 7, emphasis omitted; *see* 7-8; *see also* Reply Br. 1-3). The Examiner contends the open-ended term "comprising" in claims 1 and 15 "does not exclude any particular structure, including a spinel structure" (Answer 7-9).

We agree with Appellants that spinel structures are well known in the scientific literature.[1] On this record, we further agree with Appellants'

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[1] *See, e.g.*, **spinel**, *McGraw-Hill Dictionary of Scientific and Technical Terms* 1887 (5th ed., Sybil P. Parker, ed., New York, McGraw-Hill, Inc. 1994); Stephen E. Haggerty, **Spinel**, *McGraw-Hill Encyclopedia of Science & Technology 17*, 265-67 (7th ed., New York, McGraw-Hill, Inc. 1992) (copies not provided).

analysis of Okimura's disclosure of the spinel structure of the complex oxide catalyst as described therein. Thus, we are of the view Appellants' arguments are sufficient to rebut the prima facie case of obviousness established by the Examiner over Okimura, shifting the burden back to the Examiner to again establish a prima facie case. *See, e.g., In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). This, the Examiner has not done.

Accordingly, in the absence of a prima facie case of obviousness with respect to both grounds of rejection, each based on Okimura, we reverse the grounds of rejection of claims 1 through 15, 24, and 25 under 35 U.S.C. § 103(a).

The Primary Examiner's decision is reversed.

REMAND

We remand this Application to the Examiner to further consider the appealed claims based on the combined teachings of Park and Balmer-Millar, each of which describe compositions of metals and metal oxides, including preferred metals and metal oxides, which fall within "a catalytic metal oxide" and "a promoting metal" set forth in claims 1 and 15 as we interpreted these claims above. Indeed, each of these references teach the use of the catalyst taught therein in a catalytic system for the reduction of NOx in effluent gases from combustion sources using a fluid hydrocarbon having at least 4 carbon atoms.

Accordingly, we remand this application to the Examiner to take appropriate action consistent with current examining practice and procedure to further consider the application of Okimura as well as consider the

application of Pack and Balmer-Millar along with any other prior art developed by the Examiner, with respect to claims 1 through 15, 24, and 25 in view of our comments along with other issues that arise from the record, and determine whether a new ground or grounds of rejection should be entered with respect to one or more of these claims. 37 C.F.R. § 41.50(a)(1) (2007).

We hereby remand this application to the Examiner, via the Office of a Director of the Technology Center, for appropriate action in view of the above comments.

REVERSED AND REMANDED

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GENERAL ELECTRIC COMPANY (PCPI)
C/O FLETCHER YODER
P.O. BOX 692289
HOUSTON, TX 77269-2289